

CLAIMS

What is claimed is:

1. A motor drive for an electric machine, comprising:
 - a live line;
 - a second line;
 - a ground line; and
 - a surge protector including:
 - a first varistor; and
 - a gas discharge tube (GDT) that is non-conductive below a trigger voltage and that is conductive above said trigger voltage,wherein said first varistor and said GDT are connected in series between one of said live line and said second line and said second line and said ground line.
2. The motor drive of claim 1 wherein said first varistor has a voltage threshold that is less than a hi-pot test voltage and said trigger voltage, wherein said hi-pot test voltage is less than said trigger voltage, and wherein said trigger voltage is less than a surge voltage.
3. The motor drive of claim 1 wherein said surge protector further comprises a second varistor connected between the other of said live line and said second line and said second line and said ground line.

4. The motor drive of claim 3 wherein when a voltage on said live line exceeds said trigger voltage, said first varistor, said second varistor and said GDT clamp excess voltage between said live line and said second line and clamp excess voltage between said second line and said ground line.

5. The motor drive of claim 1 wherein said surge protector further includes a fuse that is connected in series with said live line and that creates an open-circuit when current flowing through said fuse exceeds a current threshold of said fuse.

6. The motor drive of claim 1 further comprising a rectifier that communicates with said live line, said second line and said ground line and that converts an AC power input to a DC power output.

7. The motor drive of claim 6 wherein said rectifier is a doubler-type rectifier.

8. The motor drive of claim 1 wherein said second line is a neutral line.

9. The motor drive of claim 1 wherein said second line is a second live line.

10. The motor drive of claim 6 further comprising:

a first capacitor that has one end that communicates with a first output of said rectifier and an opposite end that communicates with said second line; and

a second capacitor that has one end that communicates with a second output of said rectifier and an opposite end that communicates with said second line.

11. The motor drive of claim 10 further comprising:

a first resistor that is connected in parallel to said first capacitor;

a second resistor that is connected in parallel to said second capacitor.

12. The motor drive of claim 3 wherein said first and second varistors are metal oxide varistors (MOVs).

13. A motor drive for an electric machine, comprising:

a live line;

a second line;

a ground line; and

a surge protector including:

a first varistor;

a gas discharge tube (GDT) that is non-conductive below a trigger voltage and that is conductive above said trigger voltage, wherein said first varistor and said GDT are connected in series between one of said live line and said second line and said second line and said ground line; and

a second varistor connected between the other of said live line and said second line and said second line and said ground line.

14. The motor drive of claim 13 wherein said first and second varistors have a voltage threshold that is less than a hi-pot test voltage and said trigger voltage, wherein said hi-pot test voltage is less than said trigger voltage, and wherein said trigger voltage is less than a surge voltage.

15. The motor drive of claim 13 wherein when a voltage on said live line exceeds said trigger voltage, said first varistor, said second varistor and said GDT clamps excess voltage between said live line and said second line and clamps excess voltage between said second line and said ground line.

16. The motor drive of claim 13 wherein said surge protector further includes a fuse that is connected in series with said live line and that creates an open-circuit when current flowing through said fuse exceeds a current threshold of said fuse.

17. The motor drive of claim 13 further comprising a rectifier that communicates with said live line, said second line and said ground line and that converts an AC power input to a DC power output.

18. The motor drive of claim 17 wherein said rectifier is a doubler-type rectifier.

19. The motor drive of claim 18 further comprising:
a first capacitor that has one end that communicates with a first output of said rectifier and an opposite end that communicates with said second line; and

a second capacitor that has one end that communicates with a second output of said rectifier and an opposite end that communicates with said second line.

20. The motor drive of claim 19 further comprising:
- a first resistance having one end that is connected in parallel to said first capacitor;
 - a second resistance that is connected in parallel to said second capacitor.
21. The motor drive of claim 13 wherein said first and second varistors are metal oxide varistors (MOVs).
22. The motor drive of claim 13 wherein said second line is a neutral line.
23. The motor drive of claim 13 wherein said second line is a second live line.

24. A method for insulation testing an electric machine with a surge protection circuit without using a jumper circuit to disconnect said surge protection circuit during said insulation testing, comprising:

providing an electric machine having a live line, a ground line and a second line;

connecting a first varistor and a gas discharge tube (GDT) in series between one of a live line and a second line and said second line and said ground line; and

performing said insulating testing.

25. The method of claim 24 further comprising setting a trigger voltage of said GDT, wherein said GDT is conductive above said trigger voltage and non-conductive below said trigger voltage.

26. The method of claim 25 further comprising setting a voltage threshold of said first varistor less than a hi-pot test voltage and said trigger voltage, said hi-pot test voltage less than said trigger voltage, and said trigger voltage is less than a surge voltage.

27. The method of claim 26 wherein said surge protector further comprises a second varistor connected between the other of said live line and said second line and said second line and said ground line.

28. The method of claim 27 further comprising clamping excess voltage between said live line and said second line and between said second line and said ground line when a voltage on said live line exceeds said trigger voltage using said first varistor, said second varistor and said GDT.